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Engineering Institute Seminar

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LANL - Institutes Office

"A Compressed Sensing Application"

Thursday, May 10, 2012
3:30 - 4:30 PM
Los Alamos Research Park, TA-03, Bldg. 4200 , Suite 101,
Access Grid Conference Room

Abstract: One of the principal challenges facing the structural health monitoring (SHM) community is taking large, heterogeneous sets of data collected from sensors, and extracting information that allows the estimation of the structure's damaged condition. Another important challenge is to collect relevant data from a structure in a manner that is cost effective, and respects the size, weight, cost, energy consumption, memory, and bandwidth limitations placed on the system. In this work we explore the suitability of compressed sensing to address both challenges. Two candidate hardware solutions to implementing compressed sensing in Structural Health Monitoring applications are discussed. First, A digital version of a compressed sensor is implemented on-board a microcontroller similar to those used in embedded SHM sensor nodes. The sensor node is tested in a surrogate SHM application requiring acceleration measurements. A compressed version of the matched filter known as the *smashed filter*, has also been implemented on-board the sensor node, and its suitability for detecting structural damage will be discussed. Second, the LANL Engineering Institute/Engineering Institute Korea is currently performing a feasibility study on the use of novel compressed sensing hardware to facilitate the collection of Ultrasonic Propagation Imaging System data (UPI). The UPI System is a unique, non-contact, laser-based ultrasonic excitation and measurement system developed for structural health monitoring applications. By using appropriate data reconstruction techniques, a time-evolving image of the response can be generated. The compressed sensing concept in the UPI case involves simultaneously exciting the structure-of-interest with an incoherent pattern of laser beams. The incoherent pattern would be generated using a digital micro-mirror array. This concept is somewhat similar in spirit to the single-pixel camera developed at by Wakin & Baraniuk at Rice University.

Biography: David is currently a researcher at the Los Alamos National Laboratory Engineering Institute. His research is focusing on the applications of sparsity methods to cyber-physical research challenges in fields such as structural health monitoring, wireless sensor networks, and materials characterization. He is also involved in research to develop risk-based techniques for mitigating cyber-physical security threats posed by mobile sensor node technology such as driverless cars and drones. David received the PhD and MS from the department of structural engineering at the University of California San Diego. His research focused on the test, development and deployment of mobile-robots to wirelessly deliver energy to sensor nodes in a wireless sensor network.

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Contact Chuck Farrar at farrar@lanl.gov for further assistance.
Seating is limited.
Hosted by the Engineering Institute (EI)